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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#15

In re Application of
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Serial No.: 07/957,080

Filed: October 7, 1992

For: LUBRICANTS

Group Art Unit 1105

Examiner: Ogden

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APPLICANT'S APPEAL BRIEF

Honorable Commissioner of
Patents and Trademarks
Washington, D. C. 20231

Sir:

Introduction

The invention is concerned with a working fluid composition for use in a heat transfer device. The working fluid composition comprises a blend of two or three specific hydrofluorocarbons and a specifically defined lubricant which is at least partially soluble in each of the hydrofluorocarbon components.

The purpose of the invention is to provide a working fluid composition which can be used to replace prior compositions containing chlorofluoroalkanes which have been implicated in the destruction of the ozone layer. Normally such prior compositions also include mineral oil as a lubricant but mineral oil cannot be used with the replacement hydrofluoroalkanes because the latter tend to be insufficiently soluble in mineral oils to allow such oils to be used as lubricants. Consequently, numerous

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alternative lubricants such as polyoxyalkylene glycols terminating in hydroxyl and other groups, esters of polyols with mono- and polyfunctional acids, and halo substituted esters and ethers have been proposed as lubricants for use with the replacement heat transfer fluids.

One refrigerant which has been proposed as a replacement heat transfer fluid is 1,1,1,2-tetrafluoroethane (R-134a). This material cannot be used by itself as a direct replacement for certain prior refrigerants and it has been proposed to use mixtures of two or more refrigerants, e.g. R-134a and difluoromethane (R-32) or R-32 and pentafluoromethane (R-125) as replacements. However, as brought out in the applicant's specification, these refrigerant mixtures are also not sufficiently soluble in mineral oils to allow the latter to be used as lubricants. Moreover, the miscibility and solubility of an alternative lubricant with one component of the mixture, for example, with R-134a, does not mean that such a lubricant will also be miscible and soluble with the refrigerant mixture itself.

The applicant's invention is based, at least in part, on the use of a specifically defined lubricant which is at least partially soluble in each component of the refrigerant mixture. This enables the effective use of blends of two or three

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specified hydrofluoroalkanes, together with the indicated lubricant, as a working fluid composition in heat transfer devices.

Background of the invention is more fully set out on pages 1-3 of the applicant's specification.

Status of All Claims

The claims pending in the application are claims 1, 5, 8, 14-18, 20-24, 27 and 28. These claims are at issue in this appeal and are set forth in the Appendix to this brief.¹

Claims 2-4, 6, 7, 9-13, 19, 25 and 26 are cancelled.

Status of Amendments After Final Rejection

The applicant filed one response after final rejection. No changes were made in the claims.

The response resulted in the Examiner's withdrawal of European patent 485,979 ('979) as a reference.

¹

An amendment is being filed herewith to correct obvious errors in claims 1 and 5. The claims in the Appendix include the proposed corrections.

Summary of the Invention

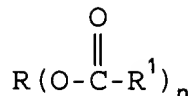
The invention at issue is directed to a working fluid composition comprising a refrigerant component which is a mixture of two or more hydrofluorocarbons selected from difluoromethane (R-32), 1,1,1,2-tetrafluoroethane (R-134a) and pentafluoroethane (R-125) and a lubricant component comprising one or more ester compounds of specified formula. See claim 1 and, for example, the applicant's disclosure at pages 3-7 and page 11, line 31 to page 12, line 21, as well as the working examples. The invention includes the composition per se (see claim 1) and the use thereof in heat transfer devices (see claims 27 and 28).

Particularly preferred heat transfer fluids for use in the invention are binary blends of R-134a and R-32 and ternary blends of R-134a, R-32 and R-125. See applicant's Examples 1-5, and pages 5-7 of the specification. Such blends are specified in applicant's claims 5 and 8, respectively.

As noted earlier, an important feature of the applicant's lubricant is that it is at least partially soluble in each component of the heat transfer fluid. See claim 1 and the disclosure at page 3, lines 19-34.

The applicant's lubricant has the general formula

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with R, R¹ and n being defined as set out in applicant's disclosure at page 12, lines 1-21 (see also claim 1).

Claims 14-18 and 20-24 are drawn to preferred subsidiary features of the lubricant based on the applicant's disclosure at pages 12-17.

The Issue on Appeal

The Examiner has finally rejected the claims under 35 USC 103 as unpatentable over WO 9012849 (hereinafter WO '849).²

Grouping of the Claims

The Examiner has grouped all of the claims together in his Section 103 rejection. The applicant considers that all of the claims should be viewed as defining subject matter which is unobvious from the citation. The claims may, therefore, be considered as a group although it is noted that the narrower

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The final rejection combined the disclosure of WO '849 with EP '979. However, the EP '979 reference was withdrawn by the Examiner in the Advisory Action, Paper No. 12. Hence, the Section 103 rejection of record rests solely on WO '849.

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lubricant definitions of, for example, dependent claims 21 and 22 take these claims even further away from the Examiner's reference.

Argument

The applicant respectfully submits that his claims define subject matter which is new and unobvious from WO '849. In particular, there is no suggestion of the applicant's combination of (a) mixtures of the specified hydrofluoroalkanes (the heat transfer fluid) and (b) a lubricant as specifically defined which is at least partially soluble in each component of the heat transfer fluid.

As indicated, the applicant's invention is based on the provision of a suitable lubricant for a particular type of refrigerant blend which must comprise one of the following four mixtures of hydrofluorocarbons:

- (1) R-32/R-134a
- (2) R-32/R-125
- (3) R-134a/R-125
- (4) R-32/R-134a/R-125

WO '849 describes the use of ester based lubricants with refrigerants containing one or more C1 to C2 fluorine-containing

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hydrocarbons. Suitable fluorine-containing hydrocarbons for the refrigerant are discussed on pages 8 to 10 of the '849 specification, particular mention being made of the hydrofluorocarbons and the hydrochlorofluorocarbons. A number of specific compounds are also listed including R-134a, but no mention is made of either R-32 or R-125.³

Furthermore, although the WO disclosure mentions the use of a refrigerant which might contain a mixture of fluorine-containing hydrocarbons, only the combination of a single tetrafluoroethane refrigerant with the described ester lubricant is actually exemplified. Thus, there is no reason why the skilled man reading WO '849 would expect ester lubricants of the type therein described to work effectively with a refrigerant comprising a mixture of fluorine-containing hydrocarbons as the applicant specifies. Moreover, since WO '849 does not even mention R-32 and R-125 as possible candidates for the refrigerant, it is clearly not correct to assume that the skilled man reading WO '849 would expect ester lubricants of the type which the applicant requires to work effectively with a

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The Examiner erroneously states in his Advisory Action that WO '849 discloses R-32. The reference does not include such disclosure.

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refrigerant comprising one of the above four mixtures of hydrofluorocarbons.

It is noted that the Examiner has acknowledged that the reference does not disclose the applicant's specific mixtures of hydrofluoroalkanes. Furthermore, the reference does not even mention the R-32 or R-125 components called for by the applicant. Clearly, therefore, there is no valid basis for concluding that the applicant's compositions, which require the use of R-32 and/or R-125, are obvious from the WO '849 disclosure. It is only by hindsight, in the light of the applicant's disclosure, that the Examiner can modify the reference disclosure to meet the applicant's invention and this is not, of course, a valid basis for rejection. The teaching of WO '849 is itself clearly insufficient to motivate the skilled man to try to develop the presently claimed compositions. One skilled in the art would not be led to the applicant's new compositions from the WO '849 disclosure when that document does not even mention materials (i.e., R-32 and R-125) which form an essential component of the applicant's invention.

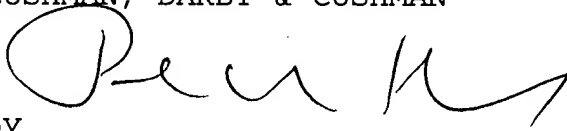
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Conclusion

The Examiner's Section 103 rejection of the claims should be reversed for the reasons noted.

Respectfully submitted,

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The claims on appeal read as follows:

1. A working fluid composition comprising:

(A) a heat transfer fluid comprising a mixture of at least two hydrofluoroalkanes selected from the group consisting of difluoromethane, 1,1,1,2-tetrafluoromethane and pentafluoroethane; and

(B) sufficient to provide lubrication of a lubricant which is at least partially soluble in each component of the heat transfer fluid, said lubricant comprising one or more compounds of general formula:



wherein

R is the hydrocarbon radical remaining after removing the hydroxyl groups from pentaerythritol, dipentaerythritol, tripentaerythritol, trimethylol, ethane, trimethylol propane or neopentyl glycol, or the hydroxyl containing hydrocarbon radical remaining after removing a proportion of the hydroxyl groups from

pentaerythritol, dipentaerythritol, tripentaerythritol,
trimethylol ethane, trimethylol propane or neopentyl glycol;

each R^1 is, independently, H, a straight chain (linear)
aliphatic hydrocarbyl group, a branched aliphatic hydrocarbyl
group, or an aliphatic hydrocarbyl group (linear or branched)
containing a carboxylic acid or carboxylic acid ester
substituent, provided that at least one R^1 group is a linear
aliphatic hydrocarbyl group or a branched aliphatic hydrocarbyl
group; and

n is an integer.

5. A working fluid composition as claimed in claim 1
wherein the heat transfer fluid (A) is a binary mixture
consisting essentially of 1,1,1,2-tetrafluoroethane and
difluoromethane.

8. A working fluid composition as claimed in claim 1
wherein the heat transfer fluid (A) comprises a mixture of:

- (1) 1,1,1,2-tetrafluoroethane;
- (2) difluoromethane; and
- (3) pentafluoroethane.

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14. A working fluid composition as claimed in claim 1 wherein the linear and branched hydrocarbyl groups specified for R^1 are unsubstituted and the carboxylic acid or carboxylic acid ester containing hydrocarbyl group specified for R^1 contains no other substituents.

15. A working fluid composition as claimed in claim 1 wherein the lubricant (B) comprises one or more compounds of Formula II in which R is the hydrocarbon radical remaining after removing the hydroxyl groups from pentaerythritol, dipentaerythritol, tripentaerythritol, trimethylol ethane, trimethylol propane or neopentyl glycol.

16. A working fluid composition as claimed in claim 15 wherein the lubricant (B) comprises one or more compounds of Formula II in which R is the hydrocarbon radical remaining after removing the hydroxyl groups from pentaerythritol, dipentaerythritol, trimethylol propane or neopentyl glycol.

17. A working fluid composition as claimed in claim 16 wherein the lubricant (B) comprises one or more compounds of Formula II in which R is the hydrocarbon radical remaining after

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removing the hydroxyl groups from pentaerythritol, dipentaerythritol or trimethylol propane.

18. A working fluid composition as claimed in claim 1 wherein the lubricant (B) comprises one or more compounds of Formula II in which each R^1 is, independently, a linear alkyl group or a branched alkyl group.

20. A working fluid composition as claimed in claim 18 wherein at least one R^1 group is a linear alkyl group.

21. A working fluid composition as claimed in claim 18 or claim 20 wherein at least one R^1 group is a linear alkyl group and at least one R^1 group is a branched alkyl group.

22. A working fluid composition as claimed in claim 1 wherein the lubricant (B) comprises one or more esters of general formula:



wherein

R^2 is the hydrocarbon radical remaining after removing the hydroxyl groups from pentaerythritol, dipentaerythritol or trimethylol propane;

each R^3 is, independently, a linear alkyl group or a branched alkyl group; and

p is an integer of 3, 4 or 6,
wherein one or more of the named polyols, one or more linear alkanolic acids, or esterifiable derivatives thereof, and optionally one or more branched alkanolic acids, or esterifiable derivatives thereof, are utilised in the synthesis of the ester.

23. A working fluid composition as claimed in claim 22 wherein a mixture of one or more linear alkanolic acids, or esterifiable derivatives thereof, and one or more branched alkanolic acids, or esterifiable derivatives thereof, are utilised in the synthesis of the ester.

24. A working fluid composition as claimed in claim 22 wherein the lubricant comprises one or more compounds of Formula III in which R^2 is the hydrocarbon radical remaining after removing the hydroxyl groups from pentaerythritol or dipentaerythritol.

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27. A heat transfer device containing the working fluid composition claimed in claim 1.

28. In a heat transfer method involving the use of a working fluid, the improvement which comprises using, as the working fluid, a composition as claimed in claim 1.